Noise Evaluation

Faribault Energy Park

Faribault Energy Park, LLC
Faribault, Minnesota

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Introduction

In conjunction with the Environmental Assessment required by the Minnesota Environmental Quality Board (MEQB), local and state ordinances for acceptable noise must be evaluated. Appropriate noise monitoring and calculations (supported by engineering) have been made to demonstrate that noise levels from the proposed Faribault Energy Park, LLC, plant will not exceed state or local noise tolerance levels. This report documents the procedures used to develop noise estimates from the proposed facility and discusses the impact on the surrounding community.

Discussion of Noise

A variety of sources in natural, industrial, and community settings generate sound/noise. Sound is defined as the result of the vibration of millions of air molecules traveling in waves to our ears. Sounds waves move outward from the vibrating source, weaken, and may be reflected or bent by obstacles as they travel. Each sound wave has a different frequency, or rate of speed. Humans are only able to hear sound that falls between 30 to 12,000 cycles per second.

In general, noise is defined as unwanted sound. Hearing damage is the most serious effect of noise, but the nuisance of particular sound characteristics may diminish the quality of life for those affected by the noise. Sound/noise is measured using a unit known as a decibel (dB). Several frequency weighing schemes have been used to derive a dB scale that estimates the level at which humans detect various stimuli. The development of this schematic is due to the fact that humans are only able to hear certain frequencies at certain volume levels. This range is typically described as the A-weighted decibel scale, or the dBA scale. Table 1 provides a summary of typical sounds and their A-weighted levels.

Noise levels are given a constant equivalent dB level in order to develop single-value descriptions of the various noise levels. These units, denoted as L_{eq}, give a numerical value to an average noise exposure over an average length of time. Time of day, annoyance, and other factors are taken into consideration when the L_{eq} rating is determined. The L_{eq} statistical descriptions are used to characterize noise conditions and are denoted as L_{10}, L_{50}, L_{90}, etc. where the number

represents the percentage of time, as an hourly average, that a noise is present and exceeds that level. For example, an air conditioning unit running in the background can be classified as an L_{90}, and an airplane flying overhead may be classified as an L_{10}.

Table 1 Typical Sounds and A-Weighted Levels

Source	Sound Pressure Level (dBA)
Jet Engine 25 m Distance	140
Jet Take Off – 100 m Distance	125
Power Lawnmower	100
Average Street Traffic	85
Business Office	65
Conversational Speech	60
Living Room (No TV)	40
Bedroom	25

Source: Introduction to Environmental Engineering

Distance is a main criterion for measuring the strength of noise. For every doubling of distance from the noise source, a decrease of 6 dB occurs from isolated sources, such as the Faribault Energy Park. When studying noise originating from a continuous line, the dB level decreases by 3 dB for every doubling of distance. This is the case when observing traffic on a street or highway. However, a higher dB decrease in noise may be considered when the source is at ground level, and the ground located between the noise source and monitor is effectively absorbing sound.

All of the above measurements are based on distance being the only varying factor. When conducting noise studies several other variants must be taken into consideration. Included among these are wind, temperature, humidity, man-made structures, and topographic elements. These elements contribute to the alteration of sound by diffracting sound waves and even increasing their intensity. All of these factors are taken into consideration when conducting a noise study.

Minnesota Rules Part 7030.0040, Subpart Two, outlines the standards followed for noise pollution control. The regulatory agency responsible for the formation and implementation of these standards is the Minnesota Pollution Control Agency (MPCA). There are currently no local ordinances for this area. These state standards, according to the definition of land use activities, demonstrate consistency with the requirements for annoyance, hearing and conversation, and sleep for all receptors within these areas classified as such.

In addition to the Minnesota Rules, the MPCA has also produced numerous noise area classifications (NAC) and the standards for each. These classifications are based on what activity is being conducted at the location of each receiver. The noise standard is then classified according to the listed NAC.

There are four noise area classifications as determined by the MPCA. NAC-1 applies to household units, hospitals, religious services, correctional institutions, and entertainment gatherings; NAC-2 land use activities consisting of mass transit terminals, automobile parking, and retail trade; NAC-3, manufacturing facilities, highway and street rights-of-way, and utilities. Undeveloped and land use areas under construction compose NAC-4. The standards for these classifications are described in Table 2.

Table 2 State of Minnesota Noise Standards

NAC	Daytime (dBA)		Nighttime (dBA)	
	L_{50}	L_{10}	L_{50}	L_{10}
1 (Residential)	60	65	50	55
2 (Commercial)	65	70	65	70
3 (Industrial)	75	80	75	80
4 (Undeveloped)	none	none	none	none

dBA = decibels, A-weighted scale; L_{10} = sound pressure level which is exceeded 10% of the time period; L_{50} = sound pressure level which is exceeded 50% of the time period.

Source: Minnesota Rules Part 7030.0040

Background Noise Survey

Stanley Consultants, Inc. conducted a preliminary background noise survey at the proposed site to determine ambient noise levels. A Bruel and Kjaer precision sound level meter, Type 2231, was used to determine background noise levels at three locations, far west property line along transmission corridor, center of property near proposed plant and eastern property adjacent to railroad and near the closest residence. The Type 2231 meter was fitted with a ½" condenser microphone. The noise levels were measured during the daytime, each second, and averaged over a three minute period. The microphone, equipped with a porous, polyurethane sponge windscreen was mounted on a tripod at approximately 5 feet above the ground. This height represents the approximate height at which the average human ear is located. The microphone is positioned at an angle of 90 degrees from the ground. Calibration checks were performed before the sampling period to assure performance of the meter's microphone using a Type 4230 Bruel and Kjaer Pistonphone. Both instruments meet or exceed ANSI standards. Monitored levels were obtained for a 30-minute period and filtered by octave band.

The results of the noise monitoring are shown in Table 3 for each location. Approximate locations are shown on the site map, Figure 1. The results indicate that existing noise levels on and adjacent to the property range from 54-60 dBA. The highest level was recorded on the western boundary and was influenced by Interstate 35 traffic. These two locations will be used as a baseline in noise impact modeling for the facility.

Table 3 Noise Monitoring Results

No./Date	Time	S-U	Octave	Max P	Max L	Min L	Leq
650 Ft NW							
01 2002-09-05	11:42:31	FIA	31	34.9	31.3	11.4	22.8
02 2002-09-05	11:45:30	FIA	63	51	47	23.8	38.1
03 2002-09-05	11:48:45	FIA	125	66.5	63.1	28.7	46.1
04 2002-09-05	11:51:44	FIA	250	56.6	52	30.0	40.3
05 2002-09-05	11:54:55	FIA	500	66	57.4	33.5	48.1
06 2002-09-05	11:57:54	FIA	1000	78.9	68.8	44.5	57.5
07 2002-09-05	12:01:07	FIA	2000	76.7	63.4	34.8	51.1
08 2002-09-05	12:04:06	FIA	4000	66	57.1	37.5	47.2
09 2002-09-05	12:07:19	FIA	8000	70.9	52.5	42.6	47.7
						Total Leq	**59.7**
250 Ft. NE							
18 2002-09-05	12:25:26	FIA	31	56.1	49.6	24.7	30.6
19 2002-09-05	12:30:19	FIA	63	58.3	53.4	27.6	41.4
20 2002-09-05	12:33:18	FIA	125	62.3	52.1	27.2	37.1
21 2002-09-05	12:36:28	FIA	250	79.5	66	34.1	49.8
22 2002-09-05	12:39:27	FIA	500	81.3	65.4	32.2	46.7
23 2002-09-05	12:42:45	FIA	1000	75.5	58.2	30.7	42.5
24 2002-09-05	12:45:44	FIA	2000	77.4	58	27.7	46
25 2002-09-05	12:48:59	FIA	4000	73.5	50.8	32.9	41
26 2002-09-05	12:51:59	FIA	8000	63	48.1	14.6	27.7
						Total Leq	**53.7**

Source: Stanley Consultants

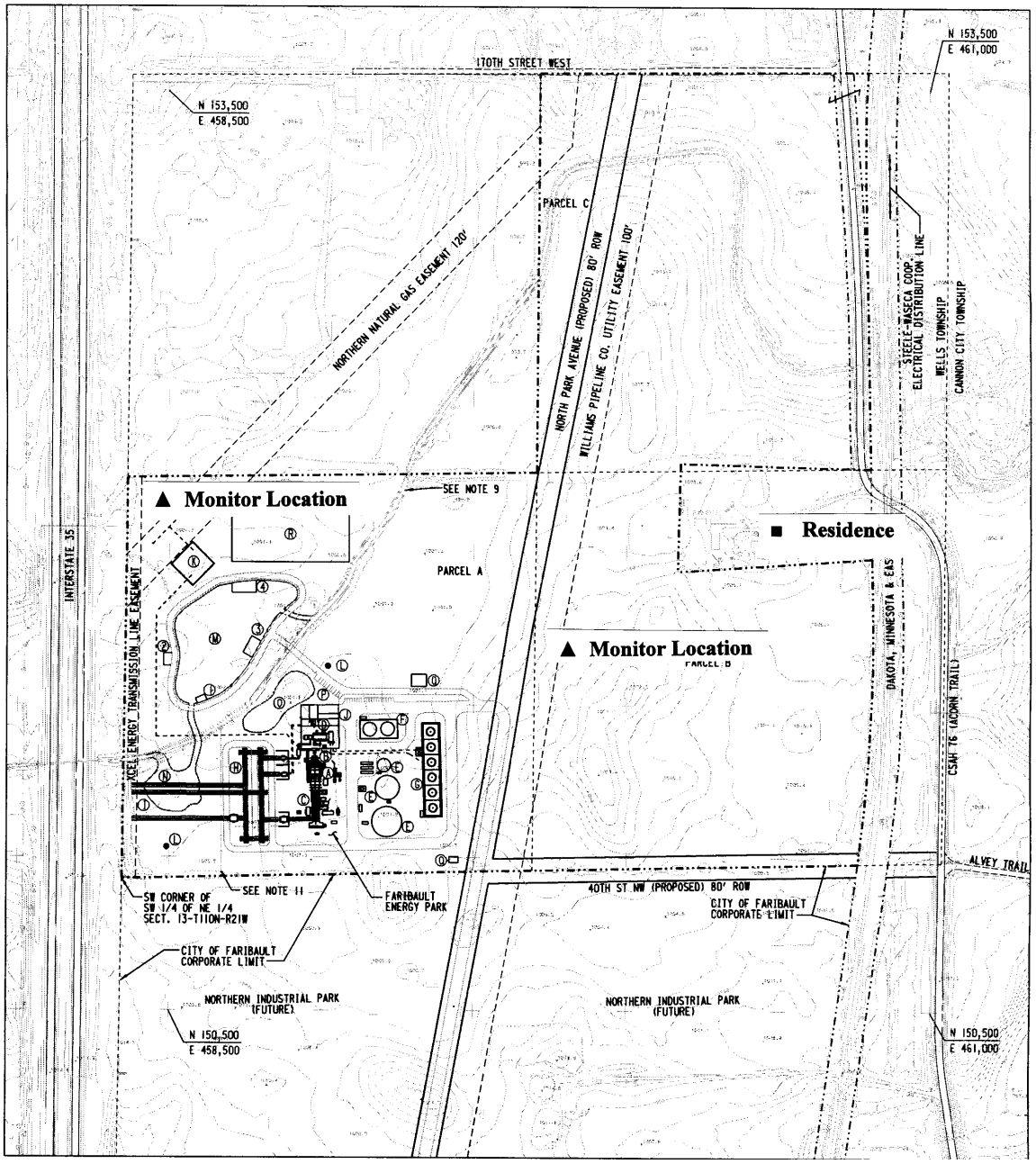

Figure 1 – Site Plan and Monitoring Locations

Noise During Facility Construction

Noise associated with project construction would consist mostly of a series of intermittent sources, most of which would originate from the diesel engine drive systems that power most construction equipment. It is likely that during peak construction, construction work may occur for 10 to 16 hours per day. Typical construction noises, as modeled for a similar power plant project in southeastern Wisconsin, are listed in Table 4.

Table 4 Estimated Maximum Noise Levels for Typical Construction Equipment (dBA)

Construction Equipment	Typical Range at 50 Feet
Steam blow off (4-8-inch line)	124-134
Air blow off (4-8-inch line)	120-130
Dozer (250-700 hp)	85-90
Front-end loader (6-15 yard 3)	86-90
Trucks (200-400 hp)	84-87
Grader (13-16-foot blade)	83-86
Portable generators (950-200 kW)	81-87
Derrick cranes (11-20 T)	82-83
Mobile cranes (11-20 T)	82-83
Concrete pumps (3-150 yard 3)	78-84
Tractor (3/4-2 yard 3)	77-82

Noise During Facility Operation

While construction noise would be generated during the development of the site and erection of the plant, operational noise would be emitted throughout the life of the plant. Major noise sources introduced by the proposed project would include the combustion turbine, steam turbine generator packages; generator step-up transformers; circulating, feed-water and condensate pumps; and cooling towers. Audible operational noise levels from the plant should be maintained at a low level compared to the existing ambient levels so that the overall increase in noise is minimal.

Estimates of noise levels at three distances from the main plant source were calculated to determine the impact of the new facility on ambient and background levels. The three distances correspond to the northwest property boundary, eastern property (original plant siting), and the closest residence to the northeast (located adjacent to the Faribault Energy Park property). See Figure 1. Estimates of noise levels from each piece of equipment generating continuous noise at the proposed facility were obtained from either manufacturer's data or from like sources previously obtained from manufacturer's estimates. Noise levels were calculated by logarithmically adding each source's contribution to total level at specific distances. Appendix A

contains the noise calculations developed for a facility envisioned on this property. Estimated noise levels from the facility at the distances calculated are summarized in Table 5. The background levels monitored previously were added to obtain the peak L_{eq}, A-weighted.

Table 5 Calculated Noise Levels for Faribault Location

Location	Linear dB	L_{eq} dBA	L_{50} dBA	L_{10} dBA
NW Boundary, 650 Feet NW	74.3	63.3	60.4	66.7
Eastern Property, 250 Feet E	82.6	70.3	67.4	72.9
Nearest Residence, 800 Feet NE	72.4	59.7	56.5	62.8

The noise calculations estimate maximum noise levels at the plant boundary to be 63-70 dBA, which is within the limits of MPCA for industrial zoning. L_{50} and L_{10} values can be estimated from the L_{eq} values by assuming a Gaussian distribution of noise levels and estimating a standard deviation. A standard deviation of 5 was estimated for this area and is based upon the MPCA standards. Noise levels generated during operation should remain fairly constant and thus deviations should be relatively small.

Conclusion

All daytime noise standards can be met for any MPCA NAC classification. Nighttime levels are also expected to be attained for industrial areas, within and adjacent to the area where the facility will be located. The nearest residence is currently located in an area without a zoning classification. Following annexation by the city of Faribault, this residence may experience levels in excess of the nighttime NAC, if zoned residential. However, if the resident's property is zoned industrial or commercial, this property will attain the NAC for nighttime levels.

Appendix A